Enterprise Transportation Analysis System Summary Report of Radioactive Material Shipments: 1999-2000

A Summary of DOE Radioactive Material Transportation 1999-2000

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1. INTRODUCTION

This report provides an overview of the radioactive material commercial transportation activity of the Department of Energy in the fiscal years 1999-2000. DOE shipped 5,207 shipments in 1999 and 4,103 shipments in 2000, with total tonnages of 97,436 and 190,821 tons, respectively. This compares to the last reported annual data (FY 1994) when 5,846 shipments totaling 25,221 tons were shipped. The data provided was collected by the Enterprise Transportation Analysis System (ETAS), which is used to compile information about the shipments made by DOE each year. The ETAS database—an extension of the Automated Transportation Management System—provides centralized collection, validation, analysis, and reporting of transportation data for shipments made by and on behalf of DOE. The automated system allows information to be retrieved and provides an assortment of querying capabilities. ETAS also serves as a program management tool for DOE, facilitating coordination across numerous contractors and sites. Transportation managers can use the database for transportation cost analyses, rate evaluation, carrier evaluation, packaging utilization, and for preparing traffic activity reports required under DOE Order 460.2.

The information in this report provides views of the shipment data separated in several ways. The primary ETAS data is reported in two major data sets—total movements and inbound collect/outbound prepaid (IC/OP). The IC/OP data covers movements that were paid by DOE. The data is also separated between waste shipments and non-waste shipments. Finally, the shipments are partitioned into nine categories based on the type of material being moved. This report also provides information on the transportation aspect of the movements. First, the shipments and tonnage are broken down by the transport mode, and then the shipments are categorized by type of container used. This collection of views into the two years of DOE RAM shipments provides insights into the overall pattern of movement and the resources employed to move the material.

Table 1. Summary of DOE Radioactive Movements for Recent Years*

YEAR	NUMBER OF SHIPMENTS	TOTAL TONNAGE
1994	5,846	25,221
1999	5,207	97,436
2000	4,103	190,821

* Information screened to avoid double counting shipments from one DOE site to another.

2. SHIPMENTS OF RAM BY OPERATIONS OFFICE

While the total number of shipments in 2000 decreased by more than 21% from the total shipments in 1999, the total tonnage almost doubled (increased by 96%). Table 2 provides an overview of the distribution of movements among the DOE operations offices. All of the offices except for Chicago made fewer shipments. Chicago only increased by about 6 %. However, five of the eleven offices increased their tonnage. The majority of the increase in tonnage is in the 97,094 tons of additional material moved by Ohio Operations Office. The total tonnage moved by all of the offices besides Ohio actually decreased by more than 20% while the Ohio office increased its tonnage by 127%. Tracking both the number of shipments and the total tonnage provides two views into the annual shipping patterns. The number of shipments is a rough indicator of the management and accounting effort required to make the shipments, since each shipment requires attention to the environmental, safety, security, and health issues as well as the financial arrangements for transport. The total tonnage provides a rough indicator of the transportation costs and the labor required to accomplish the physical movement.

In the case of shipments between DOE sites it is important to note that, because both the shipper and receiver can report a shipment, the tables reporting on movements by Operations Office have some shipments counted twice. The tables of data by mode and category have screened data to only count these shipments once.

Table 2. Total RAM Movements by Operations Office

	Total Shipments		Total Tons	
Operations Office	**1999**	**2000**	**1999**	**2000**
ALBUQUERQUE OPS.	760	616	717	528
CHICAGO OPS.	445	471	635	2,374
DOE SPECIAL PROJECTS	482	325	6,910	4,456
IDAHO OPS.	183	124	1,856	1,155
NAVAL REACTORS	184	159	451	489
NEVADA OPS.	672	619	11,062	7,902
OAK RIDGE OPS.	849	750	996	563
OHIO OPS.	654	559	76,738	173,832
RICHLAND OPS.	753	328	1,357	1,732
SAN FRANCISCO OPS.	260	219	23	89
SAVANNAH RIVER OPS.	343	216	1,043	319
Total	**5,585**	**4,386**	**101,788**	**193,440**

Considering the movements that were either inbound collect or outbound paid (IC/OP), Table 3, we can get an understanding of costs to DOE. These movements show similar decreases in number of shipments (19%) and increases in tonnage (123%). The net result was an increase in shipping costs of 74%. While several offices had significant changes, Ohio's increase of over $5 million is the primary factor in the cost increase.

Table 3. Inbound Collect/ Outbound Prepaid RAM Shipments by Operations Office

	Number of IC/OP Shipments		IC/OP Tons		IC/OP Cost	
Operations Office	**1999**	**2000**	**1999**	**2000**	**1999**	**2000**
ALBUQUERQUE OPS.	363	300	250	461	122,580	166,448
CHICAGO OPS.	245	271	333	2,089	105,675	414,342
DOE SPECIAL PROJECTS	94	161	1,148	2,569	348,841	376,144
IDAHO OPS.	138	77	1,714	851	742,819	484,018
NAVAL REACTORS	110	92	377	448	131,986	181,058
NEVADA OPS.	89	104	1,661	4	128,934	1,804
OAK RIDGE OPS.	164	110	253	76	76,954	71,826
OHIO OPS.	540	461	75,308	173,276	5,296,515	10,413,084
RICHLAND OPS.	371	130	102	1,115	97,428	217,168
SAN FRANCISCO OPS.	219	188	9	17	12,808	9,221
SAVANNAH RIVER OPS.	91	79	17	12	21,428	13,390
Total	**2,424**	**1,973**	**81,172**	**180,916**	**$7,085,968**	**$12,348,504**

Fig. 1. Total RAM Shipments by Operations Office.

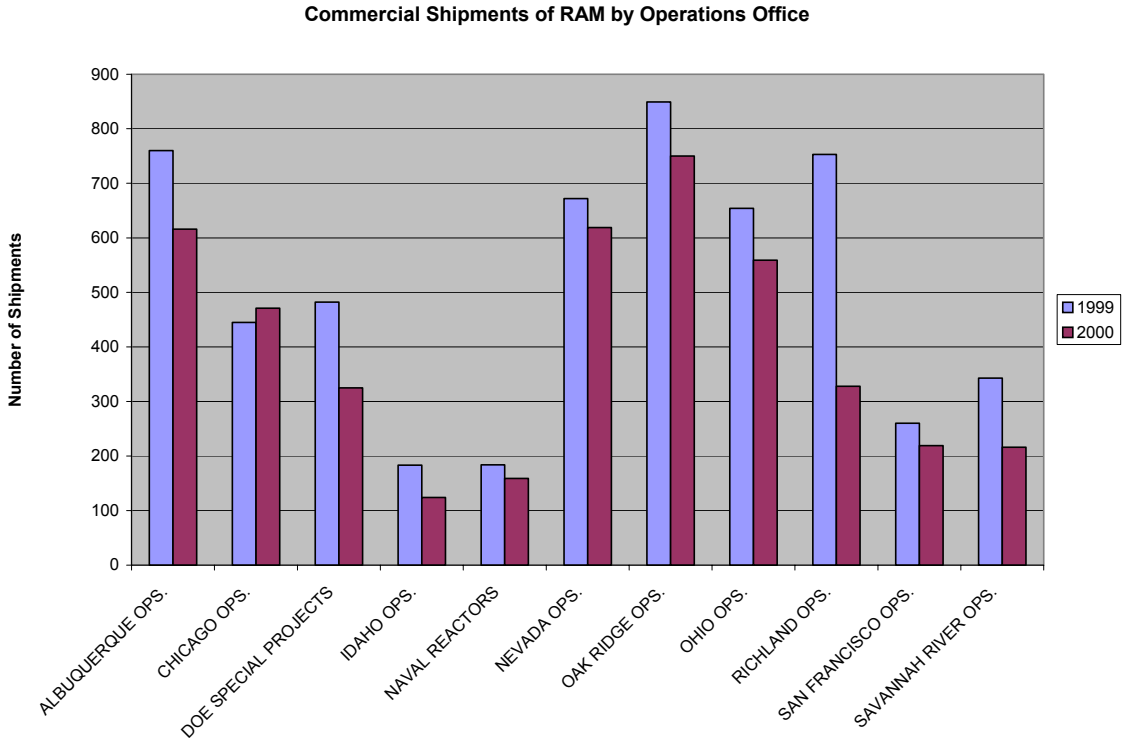
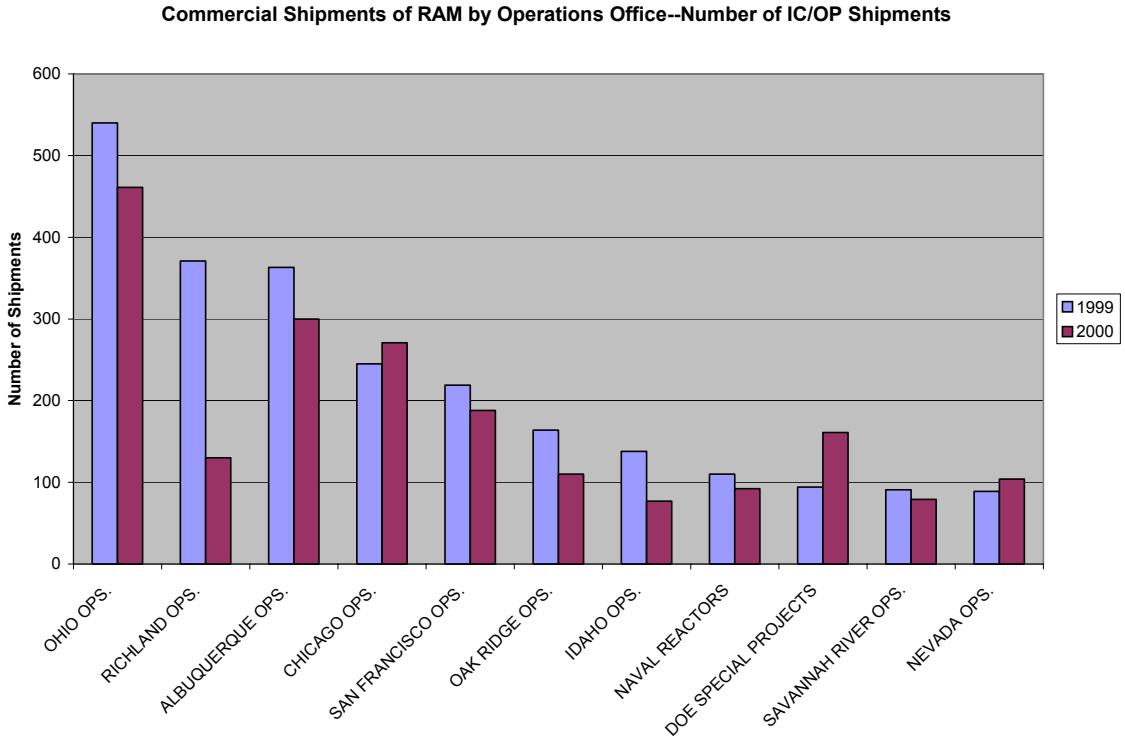


Fig. 2. RAM Inbound Collect/Outbound Prepaid.



3. WASTE MOVEMENTS

3.1 Waste Movement totals

When the data for waste movements is separated from the total RAM movements, it becomes clear that this category accounts for the majority of the increased tonnage in 2000. While the number of shipments of RAM waste remained almost constant, the tonnage increased more than eightfold (Table 4). The Ohio Office tonnage increased by a factor of almost 19. The IC/OP waste shipments account for less than half of the waste shipments; however, they do account for 90% of the tonnage indicating that the largest shipments were in this category. The IC/OP waste tonnage (Table 5) increased by a factor of 16 in 2000 while the total costs for these movements increased about six fold. The total cost for waste shipments increased by $9.2 million. This was offset by a decrease in non-waste shipment costs of $3.9 million to yield a net increase of $5.3 million for all shipments.

Table 4. RAM Waste Shipments by Operations Office

Operations Office	Total Shipments		Total Tons	
	1999	2000	1999	2000
ALBUQUERQUE OPS.	51	38	505	416
CHICAGO OPS.	54	121	411	2,119
DOE SPECIAL PROJECTS	347	200	5,640	3,385
IDAHO OPS.	83	65	1,378	973
NAVAL REACTORS	23	21	279	263
NEVADA OPS.	304	405	4,403	6,449
OAK RIDGE OPS.	340	293	616	348
OHIO OPS.	468	352	8,829	163,461
RICHLAND OPS.	57	89	856	1,635
SAN FRANCISCO OPS.	21	18	5	39
SAVANNAH RIVER OPS.	6	6	94	2
Total	**1,754**	**1,608**	**23,015**	**179,089**

Table 5. Inbound Collect/ Outbound Prepaid Waste Shipments by Operations Office

Operations Office	Number of IC/OP Shipments		IC/OP Tons		IC/OP Cost	
	1999	2000	1999	2000	1999	2000
ALBUQUERQUE OPS.	17	28	114	414	22,728	93,447
CHICAGO OPS.	26	95	299	2,001	77,796	372,827
DOE SPECIAL PROJECTS	69	143	1,121	2,501	289,940	347,259
IDAHO OPS.	66	38	1,279	687	489,425	357,451
NAVAL REACTORS	20	18	267	258	44,209	56,481
NEVADA OPS.	6	4	193	1	20,950	
OAK RIDGE OPS.	25	15	5	22	31,732	34,906
OHIO OPS.	386	324	7,412	163,241	978,057	9,712,902
RICHLAND OPS.	1	51	1	1,068	85	151,348
SAN FRANCISCO OPS.	10	13	1	1	884	148
SAVANNAH RIVER OPS.	1	5	0	1	94	6,122
Total	**627**	**734**	**10,691**	**170,193**	**$1,955,901**	**$11,132,891**

3.2 Waste as a Percentage of Total RAM

When we consider waste as a percentage of the total RAM shipments by operations office (Table 6) we see that five offices had significant increases in the ratio of waste tonnage to the office's annual total RAM tonnage—Chicago, Nevada, Ohio, Richland, and San Francisco. Of these offices, Chicago, Nevada and Richland also had significant increases in the percentage of shipments that were categorized as waste.

Table 6. Waste as Percentage of Total Shipments and Tonnage

Operations Office	Total Shipments		Total Tons	
	1999	2000	1999	2000
ALBUQUERQUE OPS.	6.7%	6.2%	70.4%	78.8%
CHICAGO OPS.	12.1%	25.7%	64.7%	89.3%
DOE SPECIAL PROJECTS	72.0%	61.5%	81.6%	76.0%
IDAHO OPS.	45.4%	52.4%	74.3%	84.2%
NAVAL REACTORS	12.5%	13.2%	62.0%	53.7%
NEVADA OPS.	45.2%	65.4%	39.8%	81.6%
OAK RIDGE OPS.	40.0%	39.1%	61.9%	61.8%
OHIO OPS.	71.6%	63.0%	11.5%	94.0%
RICHLAND OPS.	7.6%	27.1%	63.1%	94.4%
SAN FRANCISCO OPS.	8.1%	8.2%	20.4%	43.4%
SAVANNAH RIVER OPS.	1.7%	2.8%	9.0%	0.5%
Average	**31.4%**	**36.7%**	**22.6%**	**92.6%**

3.3 Waste as a Percentage of IC/OP RAM

The average percentage of IC/OP RAM shipments composed of waste (calculated by dividing the total number of waste IC/OP shipments by the total number of RAM IC/OP shipments and multiplying by 100) rose from 26% to 37% between 1999 and 2000 (Table 7). However, this average is not indicative of a "typical" operations office. In 1999, only three offices of the eleven exceeded the average, and in 2000 only four exceeded the average percentage (Fig. 3). Thus, a small number of offices accounted for the vast majority of the waste movements, and for those offices, movements were up to 90% of the office's shipments in these years. For the majority of offices, however, waste movement was less than 20% of their shipments.

When we consider the IC/OP waste tonnage as a percentage of the total IC/OP tonnage, the 1999 and 2000 averages are quite different (Fig. 4). The 1999 waste movements represented about 13% of the total IC/OP tonnage, while in 2000 the waste movements tonnage was over 94% of the total IC/OP movement tonnage. In 1999, the operations offices could be divided into two groups, the five offices that moved more than 45% of their IC/OP tonnage as waste (Albuquerque, Chicago, Special Projects, Idaho, and Naval Reactors) and the other six offices that moved less than 12% of their tonnage as waste. In 2000, two offices moved into the large waste movers category (Ohio and Richland) and Oak Ridge moved into a middle group by itself with 28.7% of its movements in waste. Given the special procedures involved in characterizing and certifying waste for disposal, it is interesting to note which offices have this task as a significant part of their transportation operations.

Table 7. Waste as Percentage of IC/OP Shipments, Tonnage, and Cost

Operations Office	Number of IC/OP Shipments		IC/OP Tons		IC/OP Cost	
	1999	2000	1999	2000	1999	2000
ALBUQUERQUE OPS.	4.7%	9.3%	45.6%	89.7%	18.5%	56.1%
CHICAGO OPS.	10.6%	35.1%	89.9%	95.8%	73.6%	90.0%
DOE SPECIAL PROJECTS	73.4%	88.8%	97.7%	97.4%	83.1%	92.3%
IDAHO OPS.	47.8%	49.4%	74.6%	80.8%	65.9%	73.9%
NAVAL REACTORS	18.2%	19.6%	70.7%	57.5%	33.5%	31.2%
NEVADA OPS.	6.7%	3.8%	11.6%	2.6%	16.2%	0.0%
OAK RIDGE OPS.	15.2%	13.6%	2.1%	28.7%	41.2%	48.6%
OHIO OPS.	71.5%	70.3%	9.8%	94.2%	18.5%	93.3%
RICHLAND OPS.	0.3%	39.2%	0.1%	95.8%	0.1%	69.7%
SAN FRANCISCO OPS.	4.6%	6.9%	5.6%	0.7%	6.9%	1.6%
SAVANNAH RIVER OPS.	1.1%	6.3%	0.0%	6.8%	0.4%	45.7%
Overall DOE Average	**25.9%**	**37.2%**	**13.2%**	**94.1%**	**27.6%**	**90.2%**

Fig. 3. Waste Shipments as Percentage of IC/OP Shipments.

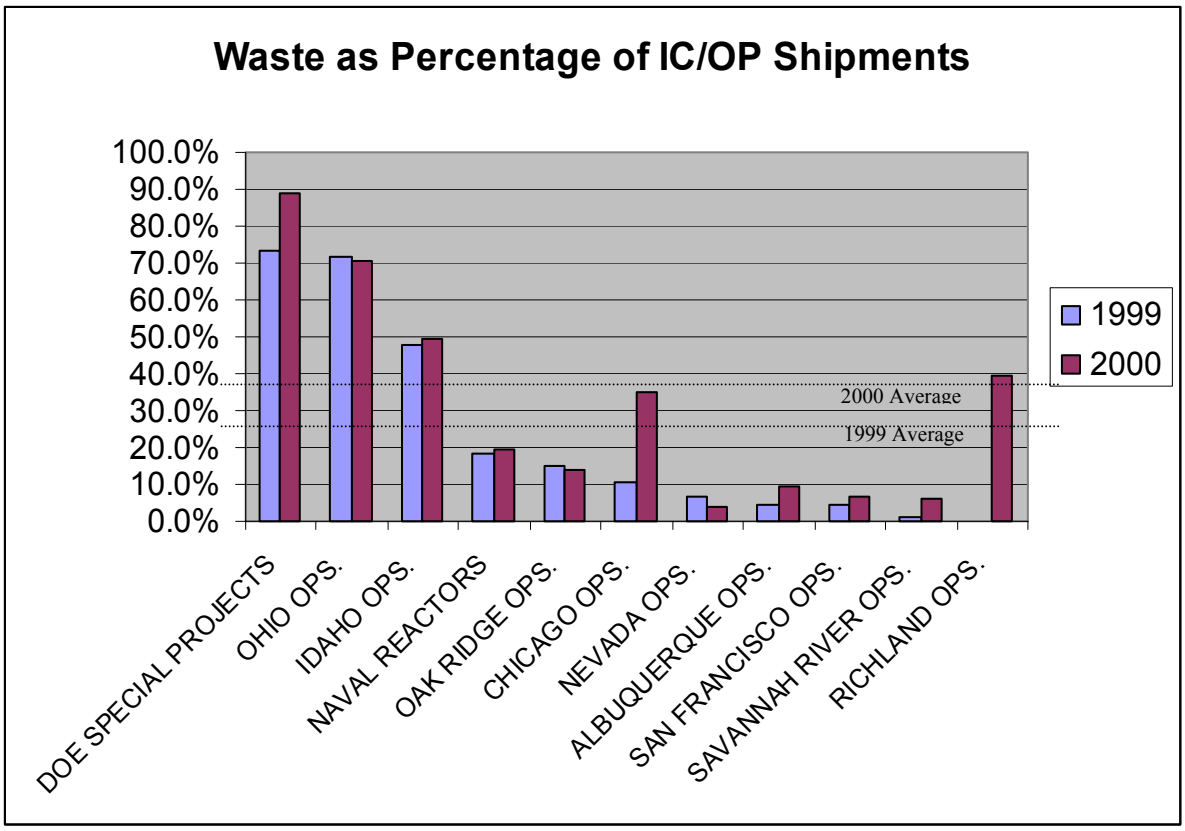
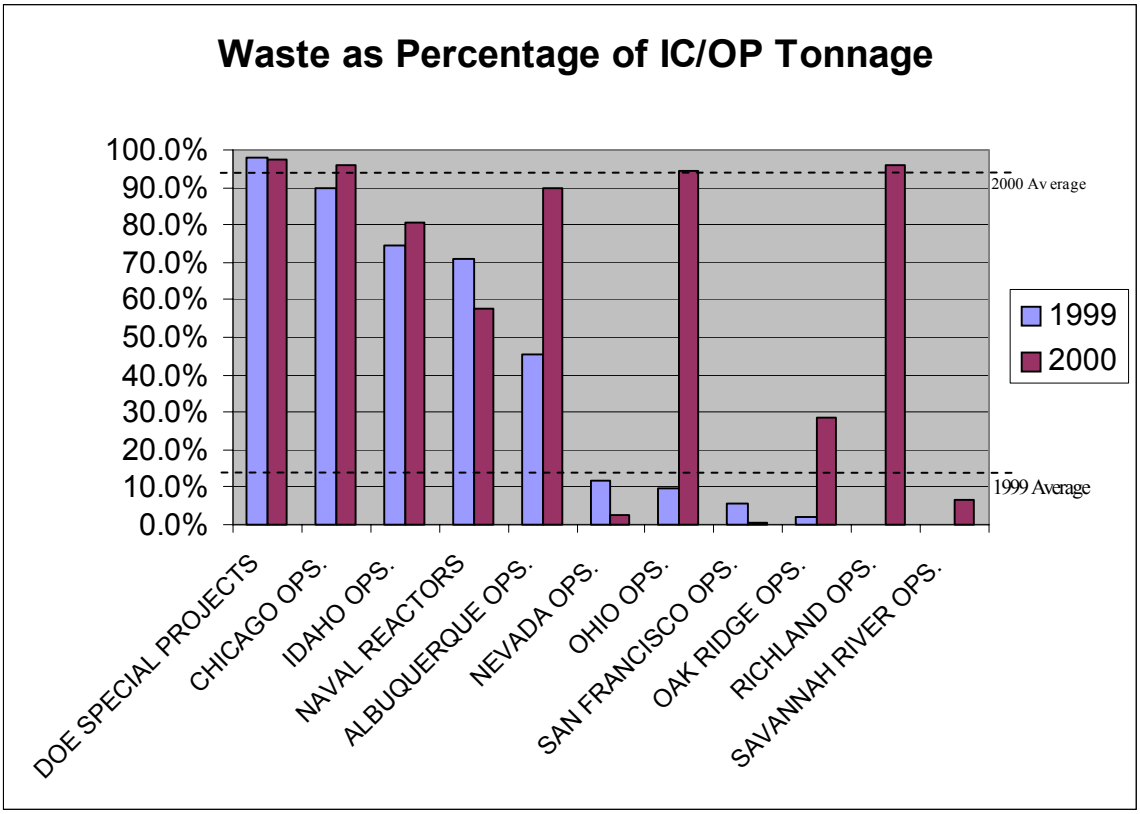


Fig. 4. Waste as Percentage of IC/OP Tonnage.



4. RAM MOVEMENTS BY CATEGORY

To provide a better understanding of what materials are being moved, we divided the movements into nine categories. These categories are not an intrinsic part of the ETAS record-keeping process, so there had to be some manual categorization of the data and some assumptions were made in categorizing movements if the exact nature of the material was not known. It is important to note that much of the weight in a RAM shipment is often the packaging and containment and not actual radioactive material. Empty containers will usually only have trace amounts of residue weighing a small fraction of the container's weight.

Table 8. Categories for RAM Movements

Category	Description
Empty RAM Containers	Movement of used packaging containing residue
Low–Level Radioactive Waste	Low-level radioactive waste
Misc. Radioactive Waste	RAM Waste not otherwise categorized
RAM, Medical/Research Samples	Relatively small quantities of specialized nuclides, instrumentation, tools, and test samples
RAM, Misc.	Non-Waste RAM not otherwise categorized
Solid Waste or Debris, Radioactively Contaminated	Contaminated solid waste and debris
Spent Nuclear Fuel	Irradiated nuclear fuel
TRU Waste	WIPP and any other known TRU
Uranium Compounds	Uranium fluorides and uranyl nitrites (intermediates in the uranium enrichment process)

When we assess the data by RAM category, several notable points arise (Table 9). There was a significant increase in the tonnage for Low-level Radioactive Waste and a slight decrease in the number of shipments. The average shipment size rose from 18.7 tons in 1999 to 46.5 tons in 2000. While other average shipment sizes increased or decreased by a factor of 2 or 3, this 14-fold increase is by far the most significant. The increase highlights the large bulk waste movements in 2000. In both years, the majority of the shipments were RAM, Medical/Research Samples and RAM, Misc. The next largest categories—Low Level Radioactive Waste and Misc. Radioactive waste—had only about half as many shipments. When viewed by tonnage (Figure 6), however, the waste categories again dominate. Figure 6 and Table 9 further show that Solid Waste accounted for the most tonnage in 1999 but dropped over 6-fold in 2000 where Low-Level Waste shipments show their dramatic increase. See Appendix A for additional information about research reactor spent fuel shipments that were not reported into ETAS.

Table 9. RAM Shipments and Tonnage by Category

RAM Category	Number of Shipments		Weight (tons)	
	1999	**2000**	**1999**	**2000**
Empty RAM Containers	219	168	846	222
Low-Level Radioactive Waste	797	726	13,465	169,806
Misc. Radioactive Waste	810	680	7,654	6,136
RAM, Medical/Research Samples	1,510	1,320	3,333	1,937
RAM, Misc.	1,500	936	694	475
Solid Waste or Debris, Radioactively Contaminated, DOT or EPA Exempt	227	109	70,409	10,763
Spent Nuclear Fuel	16	1	249	17
TRU Waste	38	59	682	1,104
Uranium Compounds	90	104	104	361
Total	**5,207**	**4,103**	**97,436**	**190,821**

Fig. 5. RAM Shipments by Category.

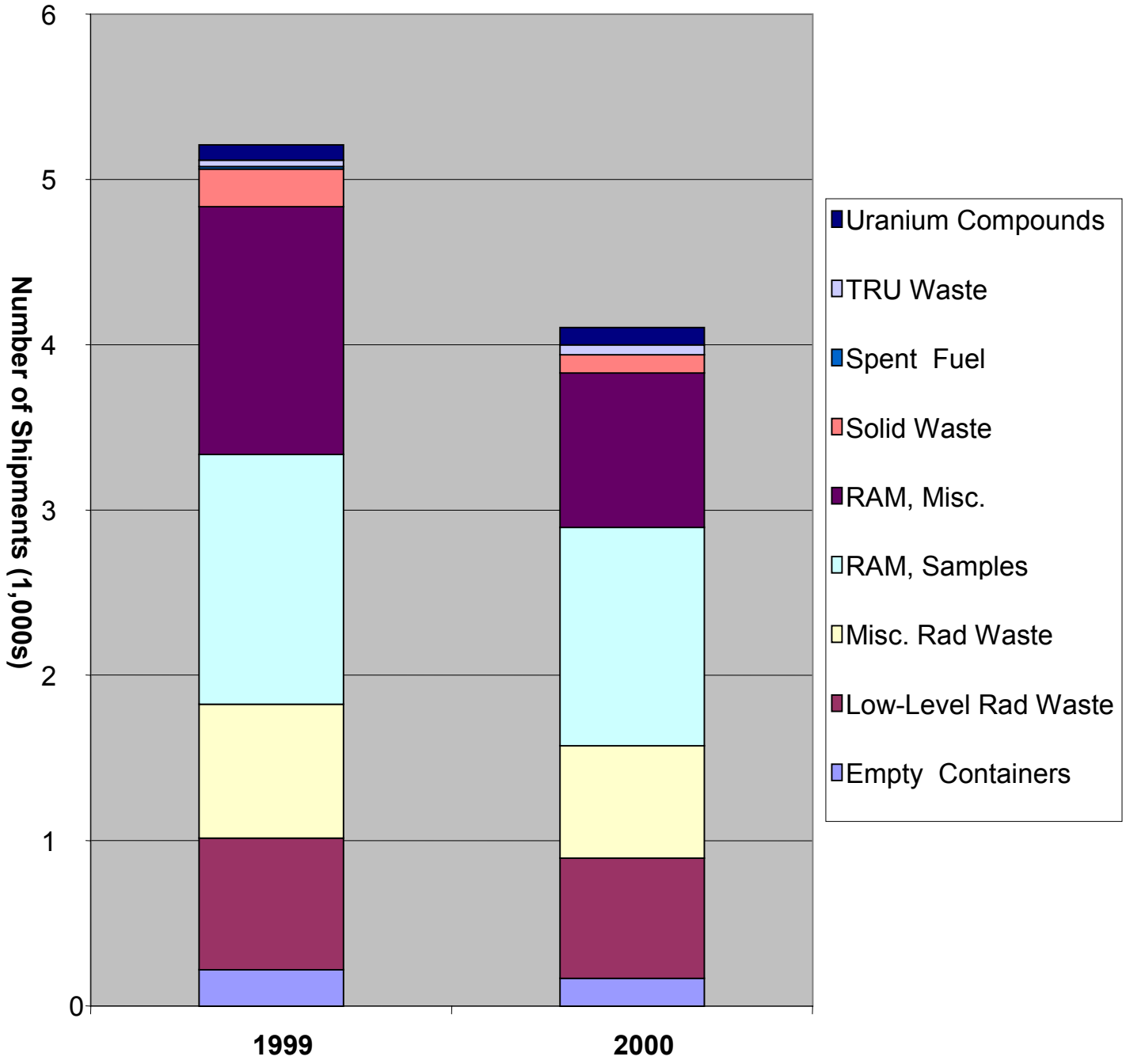
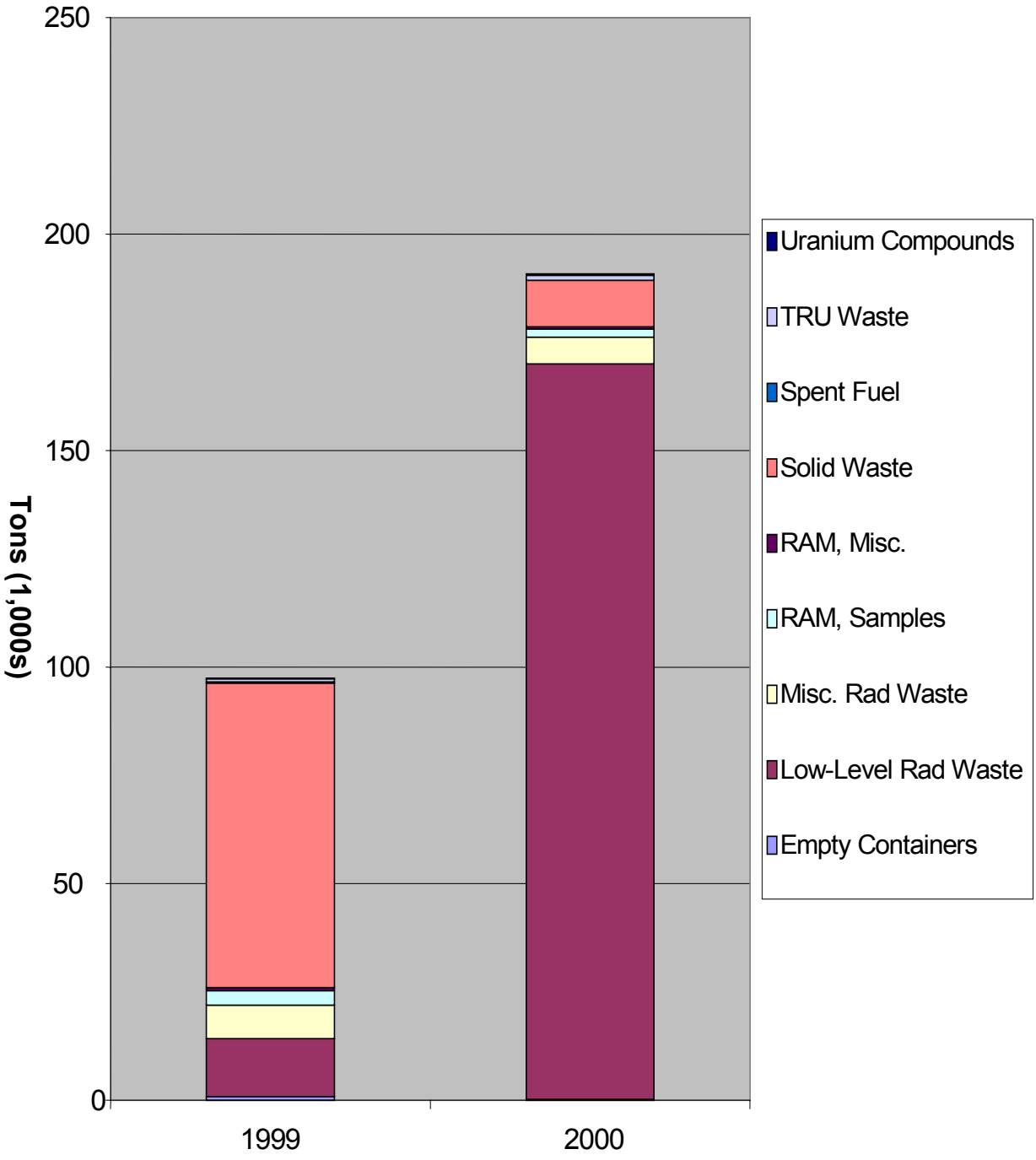


Fig. 6. RAM Tonnage by Category.



5. TRANSPORTATION MODES

Air and truck movements dominate the IC/OP shipments when considering the number of shipments. Air was the most popular mode in 1999 while motor carrier became the most popular in 2000. The large movements on rail—averaging 2049 tons per shipment in 1999 and 5990 tons each in 2000—dominate the tonnage movements (Table 10 and Figures 7 and 8). The air movements are almost exclusively by express delivery services (primarily Federal Express). While 60 motor carriers were involved in movements in 1999 or 2000, the majority of the shipments, tonnage, and cost was associated with three carriers—Landstar Ranger, Inc., Tri-State Motor Transport, and Roadway Express. In each year, these three carriers accounted for more than one third of the shipments, tonnage, and payments.

Table 10. Modal Distribution of Shipments and Tonnage

	IC/OP Shipments		IC/OP Tons	
Mode	**1999**	**2000**	**1999**	**2000**
Air	1,222	818	35	25
Motor	1,045	1,010	11,840	12,772
Other	121	92	1,687	138
Rail	33	28	67,609	167,722
Total	**2,421**	**1,948**	**81,172**	**180,657**

Fig. 7. Modal Distribution of Shipments for all RAM in 1999.

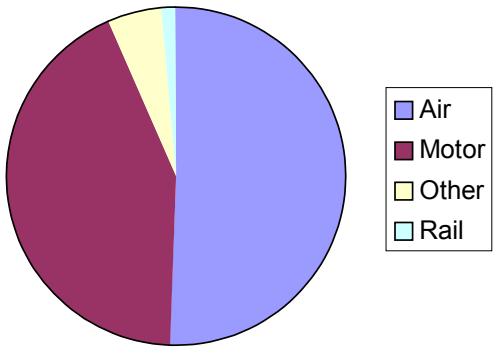


Fig. 8. Modal Distribution of Shipments for all RAM in 2000.

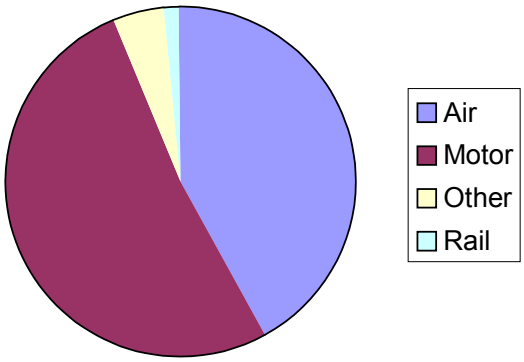


Table 11. Primary Air Carriers of RAM

	IC/OP Shipments		IC/OP Tons		IC/OP Cost	
Carrier	**1999**	**2000**	**1999**	**2000**	**1999**	**2000**
FEDERAL EXPRESS CORP MEMPHIS, TN	887	696	21.335	16.193	39,936	28,479
AIRBORNE FREIGHT CORPORATION SEATTLE, WA	254	12	1.731	0.041	8,192	231
ASSOCIATED AIR FREIGHT NEW HYDE PARK, NY	38	18	8.385	5.157	33,789	11,055
FEDERAL EXPRESS PRIORITY SERVICE (DIV OF FEDERAL EXPRESS), MEMPHIS, TN	17	63	0.487	0.917	748	1445
BAX GLOBAL LOS ANGELES, CA	9	11	1.489	0.985	3,105	3,458
AMERICAN OVERSEAS TRANSPORT LTD.(BROKER), BENSENVILLE, IL	6	13	0.039	1.518	1,403	5,391
ROSS AVIATION INC ALBUQUERQUE, NM	6	1	0.037	0.009	1,937	191
EMERY WORLDWIDE CONSOLIDATED FREIGHTWAY PALO ALTO, CA	3	3	0.344	0.139	3,450	2,293
GARCIA AND GARCIA AIR CARGO ALBUQUERQUE, NM	2	1	0.910	0.005	188	130
Total	**1,222**	**818**	**34.755**	**24.96**	**$92,748**	**$52,674**

Table 12. Primary Motor Carriers of RAM

	IC/OP Shipments		IC/OP Tons		IC/OP Cost	
Name	**1999**	**2000**	**1999**	**2000**	**1999**	**2000**
LANDSTAR RANGER JACKSONVILLE, FL	340	278	5,851	4,384	768,301	538,901
TRI-STATE MOTOR TRANSIT CO JOPLIN, MO	149	162	2,168	2,776	957,749	966,238
ROADWAY EXPRESS, INC AKRON, OH	120	96	37	57	19,035	24,037
R AND R TRUCKING CO. DUENWEG, MO	51	69	827	1,136	280,057	162,098
FLUID TRANSPORT SCHNIEDER, TX	47	36	599	527	88,648	152,936
METLER, A J HAULING AND RIGGING, INC KNOXVILLE, TN	36	76	254	1,062	81,017	221,308
PRIORITY TRANSPORT SERVICES INC SCHENECTADY, NY	34	26	190	132	40,623	43,005
INTERNATIONAL WASTE REMOVAL INC NIAGRA FALLS, NY	29	1	374	10	206,496	7,396
COLORADO ALL STATE TRANS INC JEFFERSON, CO	28	80	400	1,385	71,481	241,286
51 Other Carriers	767	756	4,962	6,915	1,316,344	1,528,513
Total	**1,601**	**1,580**	**15,662**	**18,384**	**3,829,751**	**3,885,718**

6. PACKAGE USAGE

The ETAS database tracks a package type of each movement; however, the type can be fairly generic such as “Box, Not Otherwise Specified (NOS)” or “Strong Tight Container.” These two package types alone account for more than 42% of the shipments in each year, and they are not the only “generic” package types in the acceptable list of entries. The partition of the movements by package type is provided here primarily for general interest. In the tables, “Car Load” refers to railcars.

Table 13. Summary of Package Usage in 1999

Package Description	Shipments	Tons
DOT Spec 7A container	1,156	225.8945
Box, NOS	1,146	10,715.7741
Strong Tight Container	959	6,779.0065
Drum, any type	504	1,127.57395
Carton, any type	272	60.13
Truck Load	231	5,211.927
Container	152	1,460.7855
Piece	118	1,324.5225
Fiberboard box	91	0.3065
Pail, any type, NOS	69	1.232
6M drum	65	8.7445
Pallet	63	833.964
Generic package, unspecified type	58	48.41
Normal form wooden crate	54	15.9415
Cask, any type, NOS	50	705.0395
Car load	34	67,618.6065
TRUPACT-II Cylinder	29	569.0365
Case, any type, NOS	20	3.0335
Skid	15	162.9375
GE Model 2000 lead shielded cask, GE-2000	13	218.075
Lot	12	0.195
Can, any type	11	0.4375
Technical Operations IR-192 cask	10	2.6455
B&W Mod. No. NNFD-10 Package	9	1.44
T-2 Irradiated Fuel Shipping Cask	6	67.5
Crate, any type	6	3.0425
Wood Box	5	10.6045
BMI-1 Lead Shielded Shipping Cask	4	46.4
Bin, any type	4	3
Cylinder, any type	4	0.433
Steel Drum-Removable Lid	3	0.0995
Mods. NRBK-41,NRBK-42,NRBK-43 shipping casks	3	18
GE-100 Lead Shielded Shipping Cask	3	7.2
Amersham Model 650-L	3	0.115
Steel Drum-Fixed Lid	2	0.0585
21C	2	0.0065
Plywood Box	2	0.3105
Freight cart	2	11.6415
Industrial Pkg Type 1	2	62.4015
SACK	2	33.6265
DOT Spec 6M drum	1	0.055
Gammacell 40 Irradiator	1	2.2
DOT Spec 12B box	1	0.044
GE RA-2 and RA-3 Fuel Assembly Container	1	1.385
Steel Box	1	8.15
Solid Plastic Box	1	0.005
Mod. 650 Uranium Shielded Source Changer	1	0.0375
Mod. T-3 lead shielded irradiated fuel cask	1	27.5
Bag, any type	1	19.0355
BTL	1	0.025
Deck, NOS	1	0.876
TankLoad	1	7.5845
Tank, any type	1	9.18
TOTAL	5,207	97,436.17605

Table 14. Summary of Package Usage in 2000

Package Description	Shipments	Tons
Strong Tight Container	892	6,786.70
Box, NOS	867	8,074.18
DOT Spec 7A container	723	390.74
Drum, any type	340	927.77
Carton, any type	296	85.98
Piece	188	236.73
Truck Load	118	1,808.52
Container	83	717.79
Industrial Pkg Type 2	58	752.69
Fiberboard box	53	0.28
Bin, any type	51	1,116.49
Generic package, unspecified type	48	282.98
TRUPACT-II Cylinder	47	855.50
Normal form wooden crate	38	14.42
6M drum	36	13.37
Pail, any type, NOS	33	0.19
Can, any type	29	0.33
Car load	27	167,706.86
Cask, any type, NOS	21	267.09
Pallet	21	152.96
Family of wooden boxes	20	120.99
Skid	19	143.72
Steel Drum-Fixed Lid	12	15.68
Steel Box	7	111.78
Case, any type, NOS	7	0.22
Crate, any type	7	11.97
DOT 6M-Type B container	6	48.12
B&W Mod. No. NNFD-10 Package	6	1.42
DOT Spec 7A Type A	5	0.87
DOT Spec 6M drum	4	0.18
GE-100 Lead Shielded Shipping Cask	4	9.60
Cylinder, any type	4	0.35
Plastic Drum-Fixed Lid	3	0.01
Mods. NRBK-41,NRBK-42,NRBK-43 shipping casks	3	22.50
Amersham Model 650-L	3	0.12
DOT Spec 12B box	2	0.20
5975 Cask	2	14.77
SRL Mod. 4.5 Ton CF Californium Shipping Cask	2	9.56
Mod. BCL-2 Lead Shielded Shipping Package	2	1.35
COntainer on FlatCar	2	19.43
Trailer On FlatCar	2	23.62
Steel Drum-Removable Lid	1	0.05
UNC-2600 Enriched Uranium Shipping Container	1	1.84
LLL Foamglass Container	1	9.00
Mod. 5979 Teletherapy Source Shipping Container	1	21.29
Technical Operations IR-192 cask	1	0.21
GE Model 2000 lead shielded cask, GE-2000	1	16.78
Mod. UC-609 Tritium Shipping Vessel	1	0.25
9975	1	12.61
Bag, any type	1	0.06
Industrial Pkg Type 1	1	10.19
Lot	1	0.00
Tank, any type	1	0.34
TOTALS	**4,103**	**190,820.63**

7. SUMMARY

The changes in radioactive material shipping patterns from year to year reflect the changes in the mix of DOE programs and research efforts and the timetables of various environmental restoration programs. The summary statistics provided in this report provide a means of assessing the collective impact of those changes on the overall demand for transportation management and expenses. The significant increase in cost and total tonnage shipped in 2000 is primarily the result of the efforts by the Ohio Office to remove a substantial amount of low-level waste. It is, therefore, not clear that this represents a long-term upward trend in RAM shipment amounts.

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Appendix A

RESEARCH REACTOR SPENT FUEL SHIPMENTS NOT REPORTED INTO ETAS

During the course of compiling the shipment information for this report, it was noted that the number of spent fuel shipments reported into ETAS was lower than expected. Communications with DOE and contractor personnel at the Savannah River Site confirmed that there were a number of import and domestic shipments of research reactor fuel that were not in the database being used to generate this report. SRS provided additional information on these shipments and for completeness the shipments are reported in Table A.1.

Table A.1. Research Reactor Spent Fuel Shipments Not Reported Into ETAS

Date Received	Reactor of Origin	Reactor Location	Destination	Cask Model Number	Number of Casks	Number of Fuel Assemblies
1999						
March 30, 1999		Denmark	SRS[a]			60
March 30, 1999		Germany	SRS			90
March 30, 1999		Sweden	SRS			112
April 27, 1999		Taiwan	SRS			70
April 27, 1999		Thailand	SRS			31
April 27, 1999		Indonesia	SRS			47
April 27, 1999		Philippines	SRS			51
August 19, 1999		Denmark	SRS			60
August 19, 1999		Portugal	SRS			39
August 31, 1999		Germany	INEEL[b]			76
August 31, 1999		Italy	INEEL			140
August 31, 1999		Slovenia	INEEL			219
August 31, 1999		Romania	INEEL			267 pins
November 23, 1999	KUR	Japan	SRS	18.6T KUR	2	60
November 23, 1999	JRR-2	Japan	SRS	20T	2	60
November 23, 1999	JMTR	Japan	SRS	18.5T	4	120
November 30, 1999	IEA-R1	Brazil	SRS	GNS-16	2	65
November 30, 1999	IEA-R1	Brazil	SRS	GNS-11	2	62
November 30, 1999	RV-1	Venezuela	SRS	GE 2000	1	2
2000						
June 30, 2000	SLOWPOKE	Canada	SRS	F-257	1	1
June 30, 2000	MNR	Canada	SRS	LWT	1	42
July 31, 2000		United Kingdom	INEEL		1	90
October 11, 2000		Germany	SRS			110
October 11, 2000		Italy	SRS			12
October 24, 2000		Japan	SRS			232
	HFIR	Oak Ridge	SRS	GE HFIR	11	11
	University of Michigan	MI	SRS	BMI	6	71
	MIT	MA	SRS	BMI	1	8
	NIST	MD	SRS	LWT	2	84
	MURR	MO	SRS	BMI	2	16
	UTR-10	IA	SRS	BMI	1	24

[a]SRS = Savannah River Site.

[b]INEEL = Idaho National Engineering and Environmental Laboratory.